




A biology student from Page High School samples water for *E. coli* at a Lake Powell swimming beach in Glen Canyon National Recreation Area. Students and park staff are working together on aquatic and rangeland resource management projects as a way to generate enthusiasm for science and teach lessons about land stewardship.

Outreach through scientific endeavors related to the national parks is an important role for the National Park Service. Domestic environmental education and international technical assistance exchange are two areas that are bearing fruit for the Park Service, its neighbors, and international colleagues, as the following articles indicate. As deep reservoirs of natural and cultural resource values, national parks have many lessons to teach about this nation's natural and cultural legacy. Scientific outreach is an effective way of making meaningful connections with park neighbors and international partners. For example, students participating in curriculum-based science education programs with parks are developing an interest in science and its role in park management, and are also forming important personal bonds with these places. This sense of ownership bodes well for the future stewardship of the national parks. Likewise, international assistance brings governments together to solve complex natural resource management problems collectively and to share in the benefits of increased international conservation. Both nurture goodwill and further the application of science in the management of national parks.

Student Involvement

Glen Canyon benefits from local science education program

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"Kids learn first-hand about the threats to their local environment. They have shared this enthusiasm with their parents, and that, in turn, has generated unprecedented community support for preservation of the very resource that is the economic lifeblood of the region."

—Jerry Spangler, *Deseret News*, 10 March 1999

High school biology students are working hand in hand with park scientists on aquatic and rangeland resource management projects at Glen Canyon National Recreation Area (Utah and Arizona). This multifaceted partnership between the Page School District in Arizona and Glen Canyon provides public education on Glen Canyon's fragile resources. The program reaches a high percentage of Navajo and female students who will help cultivate a diverse workforce including resource managers.

The curriculum-based research and science program, in cooperation with the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Service, provides student-acquired data for maintaining local golf course ponds as a viable grow-out facility for fish augmentation. Razorback suckers, endangered fish endemic to the Colorado River

Basin, are being reared in the ponds to maintain a backup brood stock and to grow large enough so they are not vulnerable to predation when stocked in the wild. Students routinely monitor water quality, fish growth, and health, and harvest fish for stocking. In 1999, 7 out of 153 of the stocked fish from the golf course ponds were recaptured in Lake Powell and the San Juan River, a high recapture rate for razorback suckers.

"Students provide a necessary link between the local community and federal land managers."

Students also contributed to the collection of razorback sucker larvae in Lake Mohave, at the southern end of Lake Mead National Recreation Area, to help the Native Fish Work Group reach their projected capture rate for 1999. They also assisted with pit-tagging bonytail chub, an endangered species, for stocking.

Students are currently working on two other projects: bacteria monitoring at Glen Canyon National Recreation Area and a new rangeland ecology study. They learn the scientific basis for water quality and rangeland management decisions, both highly political and economic issues in the park. Through these courses they are given an opportunity to be involved in an internship with Utah State University,

Glen Canyon National Recreation Area, and the Bureau of Land Management. A Navajo student completing a rangeland ecology study for the park was told by Navajo elders that “when the wind blew, the land looked like a yellow ocean” because of the swaying knee- and waist-high vegetation. Her goal is to help restore the vegetation and “make this land a yellow ocean once again.” She is a recipient of the American Museum of Natural History’s Young Naturalist Award 2000 for her telling paper about her rangeland study being completed at Glen Canyon.

These students provide a necessary link between the local community and federal land managers. Students create original presentations on their project work, which they give to park managers, community members, and younger students. More than 1,600 students have attended these presentations. These programs generate enthusiasm and provide outreach education, teaching lessons of stewardship along the way. With a firm foundation in the role of science in land management decisions, the youth of this community will move forward and make strong, environmentally sound decisions that affect not only this park but also other public lands in years to come.

This partnership is dependent on funding from the Arizona Community Foundation, National Park Foundation “Parks as Classrooms,” NPS “Parks as Classrooms,” and the National Park Foundation–Exxon Corporation “P.A.R.K.S.” program. The education program recently received national recognition when it won first place in the Sea World–Busch Gardens Environmental Excellence Awards, Wildlife Partners category, providing further fund-

ing for the expansion of this outstanding program. A new “Lake Level Transition Zone Study” project targeted for seventh graders will be made possible in year 2000 by a Toyota TAPESTRY Grant for Teachers allowing a new audience of students to conduct science in Glen Canyon National Recreation Area.



Students of the curriculum-based research and science program tend to the welfare of the razorback sucker, an endangered fish species. Data collected by the students are used to maintain healthy living conditions in a golf course pond, where the fish are reared for restoration of the species and maintained as a backup brood stock.

Students help meet the research needs of the present and future

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On 3 August 1999, Hanley helped to catch a specimen of the damselfly *Enallagma civile*, which proved to be a species previously unknown in Great Smoky Mountains National Park (Tennessee and North Carolina). Two weeks later, Amanda and Teddi discovered an adult *Desmognathus santeetlah* in their salamander-monitoring transect, a species more commonly found 1,000 feet higher up in the mountains. In late September, Jessie sorted through 50 moths caught the previous night, examining one with puzzling characteristics that proved to be a new park

record: *Agriphila ruricolella*. These four researchers, ages 13 to 17, and five other student research interns are part of a new program begun in 1999 to make science real to students, grades 8–12, by helping them collect data for use by park managers and scientists. This multiyear project has the goal of attracting and exciting students who will be the next generation of scientists, resource managers, and taxonomists to work in the park.

These student researchers are trained and supervised by the science education specialist at the environmental education center inside the park (Great Smoky Mountains Institute at Tremont). This education specialist identifies and implements opportunities for local students to learn

about scientific research in the park through hands-on participation, integrating science and education. Park management identified this education specialist position as its highest priority for funding from the Natural History Association donation account in FY 1999. Supervisors from both the park Resource Management and Science and Resource Education Divisions join the director of the institute to oversee this education specialist to facilitate exchange of skills, ideas, and knowledge among the partners.

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In 1999 nine student research interns underwent training and took part in studies of moths, salamanders, pond invertebrates, rhododendrons, and the ecological effects of nonnative plants. One result is that 57 new species of moths have been added to the park All Taxa Biodiversity Inventory (ATBI

[see brief article on page 28]). More students will be added to this team in 2000.

The park and its partners are working to expand the program to reach even more students. A Parks as Classrooms eighth grade unit on biodiversity, a summer high school field science course, and a high school field science camp are all being developed for 2000. Student research interns will be demonstrating their projects to visiting school groups. For students younger than grade 8, hands-on projects that mimic the real data-collecting research are being implemented to teach them the techniques and spark their interest.

This science-education integration addresses the park themes of biological diversity and abundance and the scientific opportunities presented by relatively undisturbed ecological communities. It also addresses the needs of the present and future. Results of the ATBI will support management decisions by future generations of park managers. In order for ambitious projects like these to succeed, the park needs many technicians to collect data now and many new scientists and taxonomic specialists to interpret the data collected.



A student research intern searches for crayfish as part of an initiative at Great Smoky Mountains National Park to integrate science and education. The program makes science come alive for students in grades 8–12 and is also a source of data for the All Taxa Biodiversity Inventory.

Community Collaboration

Bear-proofing garbage cans near Great Smoky Mountains National Park

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Black bear population density at Great Smoky Mountains National Park (Tennessee and North Carolina) is one of the highest in the eastern United States, and visitation to the park exceeds 10 million people annually. This situation increases the likelihood of bear-human conflicts. Reducing a bear's access to human food and garbage is a priority for park resource managers. In recent years the park has made several improvements in bear management. These include incorporating animal-proof dumpsters, modification of work schedules for maintenance personnel, earlier closures of picnic areas, installation of food-storage cables in backcountry campsites, development of educational materials, and increased monitoring of bear activity in developed areas.

During 1999, park staff worked with Gatlinburg city officials, state biologists, and private individuals to develop an ordinance for mandatory animal-resistant garbage containers in areas of Gatlinburg that are adjacent to the park. Bears were becoming "garbage-conditioned" when they crossed the park boundary and were creating problems

in both the city and the park. Bears in the city of Gatlinburg are not new; a bear task force was established for Gatlinburg in 1988 to address this issue. City officials, however, repeatedly voted down the proposed ordinance, but were finally convinced of its need by local response to the numerous bears killed (i.e., shot, poisoned, hit by vehicles) in backyards, parking lots, and trash receptacles in the city.

**"The ordinance requires residents ...
to 'bear-proof' their trash
receptacles...."**

The ordinance requires residents of designated zones and managers of food-producing businesses throughout Gatlinburg to "bear-proof" their trash receptacles by 1 June 2000. The ordinance will ultimately save the lives of many park bears in addition to other wildlife. The park plans to work with the Tennessee Wildlife Resources Agency to aggressively manage or relocate any garbage-conditioned bears that show up in Gatlinburg in spring in hopes of breaking the garbage dependency cycle passed down from females to their cubs. The next step is to work with this state agency to address the intentional feeding of bears, which is currently legal in Tennessee.



David and Linda Morris

Animal-resistant garbage containers are becoming a common sight in Gatlinburg, Tennessee. In 1999 the city adopted an ordinance requiring residents of designated zones near Great Smoky Mountains National Park and managers of food-producing businesses to "bear-proof" their trash receptacles. To promote the change, the city set up this demonstration site where residents can see and purchase various designs.

International Outreach

Parallels in ecological preservation challenges in U.S. and Canadian national parks

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In late 1998, Parks Canada invited the U.S. National Park Service to participate in a Panel on the Ecological Integrity of Canada's National Parks. The Minister of Canadian Heritage called for the panel because of a growing awareness that Canada's parks are under stress. As in the United States, Canadian parks are meant by law to be maintained unimpaired for the enjoyment of future generations. However, almost all of Canada's 39 national parks are being stressed by habitat loss and fragmentation, loss of large carnivores, air pollution, pesticides, exotic species, or overuse. The panel was to assess the strengths and weaknesses of Parks Canada's approach to maintaining ecological integrity in Canadian parks and to recommend improvements in these methods. The 11-member panel, which conducted its first field visit in January 1999, comprised a biologist from the Mohawk Council of the Akwesasne, several academics and consultants, a member of a nongovernmental organization, and a Parks Canada scientist. It also included two advisors, one of whom was the author, to represent the international community broadly and the United States specifically.

Over the past several years the U.S. National Park Service has increased its technical involvement with other governments regarding the management of park natural resources. While these exchanges may respond to specific requests for help, they also build collaborative relationships and provide opportunities for the Park Service to learn from managers of parks in other parts of the world. Canada's request for an NPS participant on the panel gave this bureau a chance to exchange ideas with a sister park service and to consider the striking parallels between ecological integrity problems and their potential solutions in Canadian parks and those in the United States.

The panel found that park ecological integrity is being impaired and that a majority of Canadian national parks have significant threats to their natural resources. These threats originate from both inside and outside park boundaries. Solutions are not simple and will require a broad range of initiatives. Participation by citizens, commerce, conservation organizations, and governments will be needed to protect Canada's national treasures.

The findings and recommendations of the panel, published by Parks Canada,¹ are similar to those of the NPS 1999 Natural Resource Challenge and 1980 report on threats to U.S. national parks. This commonality suggests several key points. Worldwide, park natural resources are at risk because of human population growth. Park management must change if parks are to accomplish their statutory mission to protect natural resources unimpaired for future generations. Everyone, not just a few park resource managers, is a contributor to the long-term protection of park natural resources.

The development of the panel's report and the Natural Resource Challenge are serendipitously coincidental. Each identifies a common challenge and offers comparable solutions. Each stresses the need for investment in inventory, monitoring, research, and adaptive management. By sharing

“Both the panel's report and the
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knowledge and effort through partnership with Parks Canada, the National Park Service can improve its own field methods, data management techniques, and assessment processes more rapidly and effectively. The two countries also have natural resources in common—migratory animals, ecosystems that extend to both sides of the border, and gene pools of wide-ranging species. By working together, each nation's park service can contribute to the well-being of continental biota. Finally, both the panel's report and the Natural Resource Challenge encourage environmental leadership, especially in action. In striving to be environmental leaders, there is room for partnership. There is also room for healthy competition of ideas and action—competition that can benefit not only both countries but also national parks throughout the world!

¹Parks Canada Agency. 2000. Unimpaired for future generations? Protecting ecological integrity with Canada's national parks. Volume I—A call to action. Volume II—Setting a new direction for Canada's national parks. Report of the Panel on the Ecological Integrity of Canada's National Parks. http://parkscanada.pch.gc.ca/EI-IE/index_e.htm. Ottawa, Ontario.

Growing and greening the economy of Vietnam: A role for the National Park Service?

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Both the beauty and squalor of Ha Long Bay proclaim that much is at stake presently in the environmental history of Vietnam. But can the U.S. National Park Service make a difference? At the invitation of The World Bank, special assistant to the director Brooke Shearer and the author attended a conference in Ha Long Bay in April 1999. The Bank believes that the National Park Service's long experience in protecting, managing, and regulating U.S. natural resources makes it well suited to help developing nations like Vietnam get control of their own resources before they are lost.

The Park Service invited Costa Rican economist and former environment minister Rene Castro Salazar to be a member of the team. His assignment: to speak to the Vietnamese as one small, developing country to another. Under his leadership, Costa Rica's economy had prospered from investing in green infrastructure—biodiversity protection and research, park development, and ecotourism.

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Ha Long Bay became a world heritage site in 1994. However, with no special staff for site management and little control of visitors or activities along its borders, the spectacular limestone island caves and quaint coastal villages are fast deteriorating, becoming crowded, tacky, and polluted. Additionally, from an environmental point of view, Ha Long Bay has always been a high-impact area. The most serious problem has been coal mining and the storage and transport of coal in coastal waters.

As part of the conference, the team toured Ha Long Bay and witnessed untreated sewage from the town being released directly through a large pipe onto the shore. (The team was told later that over 90% of domestic waste in

Vietnam is untreated.) Also, mangroves, a key feature of the bay's special character and habitat, had apparently been sacrificed to build the hotel and sandy beach. The need for environmental standards was obvious. So too was the need to demonstrate that tourism does not have to lead to haphazard development—a lesson that already has been learned in many other places.

Now enter the Japanese. Since the early 1990s, they have become major donors to Vietnam. At Ha Long Bay they are financing a big port and bridge-building project, located at the edge of the world heritage site. Once the new port project is complete, one large ship will go through the area every 15–20 minutes, according to economic forecasters. Indeed, The World Bank planned its Ha Long Bay conference to take advantage of the economic slowdown in Japan and the region, hoping the crisis might encourage Vietnam to reexamine its long-term interests.

As part of the visit, the team also drove north of Hanoi to see Cuc Phong, one of Vietnam's oldest national parks. The park staff is as dedicated as any, but poachers are capturing the resident primate fauna for export. Conservation groups from abroad, such as the Primate Rescue Center, are rescuing animals at the border, and there are small captive breeding programs under way. But visitor education and interpretation at the park are inadequate; the park's roadway promises future harm to the forest wildlife; and little attention has been devoted to involving nearby villages in park protection and programs.

American Ambassador Pete Peterson, himself a Vietnam War veteran, has appealed to the National Park Service to partner with parks in Vietnam. The Department of State also strongly encourages the Park Service to pursue cooperation with Vietnam—before it is too late. The team's participation in the conference marks a beginning in this process.

Program to preserve Neotropical migrants takes flight

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In 1999 the National Park Service began to implement a new initiative to assist Central American nations in the conservation of shared species of Neotropical migratory birds. Called the Park Flight Program, the initiative is a partnership among the National Park Service, American Airlines, and the National Park Foundation. The program will support Central American park managers through technical assistance and training, enabling them to better protect important habitat for shared migratory species. The long-term goal of the Park Flight Program is to create a framework for the “co-management” of shared migratory species facing a precarious future. This goal will be carried out through the formation of sister park relationships and other forms of NPS technical support.

The Park Flight Program has its origin in a series of 1997 and 1998 contacts between Michael Soukup, associate director for Natural Resource Stewardship and Science, and several Central American environmental and conservation officials, who developed the concept for a joint cooperative program to protect shared migratory species and their habitats through technical exchange and cooperation. To accomplish this goal, the program needed a small quantity of project start-up funds and a few airline tickets. The tickets would be used for travel by either NPS or Central American park personnel for training, technical assistance activities, or the exchange of information on shared migratory species.

American Airlines has stepped forward to provide more than \$330,000 in program funds and 45 round-trip airline tickets, facilitated through the efforts of the National Park Foundation.

In December 1999 the National Park Service sent a five-person team to Central America to define the scope of the Park Flight Program and to assess the interests and needs of Central American park managers and wildlife biologists. The NPS team's trip report identifies both short-term and long-term program activities; a copy is available from the authors. The National Park Service hopes to select the migratory species and U.S. and Central American parks that will be the focus of technical assistance and support efforts and to start funding exchange projects in 2000.



Park biologist Ingrid Arias guides NPS resource managers through Cerro San Gil Reserve in Guatemala. The small NPS contingent visited parks in Central America in late 1999 and began coordinating the Park Flight Program, an international training and technical support initiative for the conservation of shared migratory species and their habitats.

Award-Winner Profile

KAREN WADE HONORED FOR ADVANCING RESOURCE PRESERVATION



Karen Wade is winner of the 1998 Director's Award for Superintendent of the Year for Natural Resource Stewardship, presented in 1999. As superintendent of Great Smoky Mountains National Park, North Carolina and Tennessee, Karen encouraged her staff to initiate the All Taxa Biodiversity Inventory, an ambitious effort to identify all species living in the park. Under her direction the park developed a strategy to complete the inventory without significant federal funding.

Karen is widely regarded as a creative thinker and believes strongly that partnerships among a broad cross-section of constituents are key to solving problems related to park issues. “Common values are the glue that holds society together,” she says. “Not surprisingly, for many communities located adjacent to national parks, the resources embodied within park boundaries are reminders (and sometimes reminders) of those values.” What can the National Park Service do to enhance understanding of these connections? Karen views educational efforts as vital. She says, “We can excite public interest further by delivering the mysteries of new scientific discoveries to their doorsteps. And it makes sense that the more we involve in our work those neighbors with the most obvious common interests, the stronger our attachments will become and the more relevant our parks will become.” In 1999 Karen became intermountain regional director of the National Park Service.